

[001] SHIFTING UNIT

[002]

[003]

[004] The patent concerns a switch as per the type defined in the preamble of claim 1.

[005]

[006] Modern transmissions, particularly in commercial vehicles, are increasingly controlled electronically; whereby the shift power is generated pneumatically or hydraulically, which improves the shift speed as well as the shift comfort. Transmissions of larger commercial vehicles are often divided into a main transmission, a split auxiliary transmission and a range auxiliary transmission. For example, this exhibits a pneumatically supported switch that executes the pneumatic gearshifts in split auxiliary transmissions and in regional-group gears; while the gearshifts in the main transmission could be supported by the synchronization with the help of the gear brakes at high shifts and with the help of motor for shift-in in the executing force by pneumatic.

[007] Such a switch for a gear is described in the DE 100 29 497 A1. This electro-pneumatic switch for a vehicle gear that exhibits a pneumatically shifted, split auxiliary transmission over valves and pneumatically shifted regional-group gear over a valve, requires an opening and a closing valve for each shift chamber of a switch cylinder that are linked to an air supply and an exhaust control with the cylinder chamber. If one of these valves fails then the functionality of these valves could not be changed for each cylinder chamber, whereby the availability of entire system is restricted and is not available in certain cases. Additionally, the dynamics of switch cylinder is very much limited.

[008] The underlying task of the present patent is to represent an unrestricted availability of the switch also in case of valve failure, while not requiring thereby a solution involving complicated, failure contingent additional space. Further, the switch should improve the dynamic performance of the overall transmission system.

[009]           The invention based on the task underlying the patent is released by a switch exhibiting the main feature of the main claim.

[010]

[011]           Complete availability of the overall transmission system during a single error in the switch thus allows that through the additional valve the pressure supply and pressure exhaust supply separated from each other could be closed and opened. Each cylinder bracket is populated with at least one valve with both opening and closing functions. Thereby it is possible to swap the functionality of the valves, whereby the function of each switch valve can be reversed. For valve error, e.g., through a short-circuit or a failure in supply of current, the valve is in an end position that cannot be turned off and thus the second position cannot be received. Consequently, the ventilation and exhaust of respective cylinder brackets cease to function, leading to a failure in the valve's functionality. Through the possibility of reversal and/or blocking and opening of the ventilation and exhaust, the second valve of the cylinder chamber takes over the usual function of the first valve of the cylinder chamber. Additionally, dynamic features like response time, acceleration of cylinder piston, damping, etc., can be improved.

[012]           Through the assembly of one or more valves in the pressure supply and the pressure exhaust supply lines, each line can be ventilated or exhaust or a closed system (capsule) within the system. Further, all the lines can supply pressure or exhaust or block. Thereby each valve can fulfill more tasks (pressure supply or pressure exhaust or blocking).

[013]           Complete availability in case of a single valve error can be reached through the pressure supply and pressure exhaust supply being swapped through the assembly of one or more valves in the pressure supply and pressure exhaust supply lines. Thereby the function of each valve can be reversed. For example, a valve in the feeder line is permanently opened by a short-circuit and pressure should be developed in the cylinder space, the feeders are exchanged. Thereby the defective valve affects a pressure reduction in the cylinder chamber. A further

improvement allows achieving the pressure line and pressure exhaust supply through the separate opening and closing as well as blocking (damping).

[014] A change of dynamics can thereby be achieved in that all the inner system pressure supply and pressure exhaust supply lines are closed. Further, a feeder line can be a pressure supply line and the other is closed. Further, a feeder line can be a pressure exhaust and the other is closed.

[015] The usual function of the cylinder chamber valve is available instead through the availability of reversal and/or blocking and opening of the pressure supply and the pressure exhaust.

[016]

[017] The invention and the execution example represented in the figure are described in detail below.

[018] The only figure shows the parts of the invention's switch 1, essentially an automatic switch with a basic gear, a split auxiliary transmission, a range auxiliary transmission and a gear brake.

[019]

[020] A switch 1 displays switch cylinders 2, 4, 6 and 8 that can be placed in a common housing (not shown here). The switch cylinder 2 exhibits switch chambers 10 and 12, the switch cylinder 4 switch chambers 14 and 16, the switch cylinder 6 switch chambers 18 and 20 as well as the switch brackets 22 and 24. The switch bracket 10 of switch cylinder 2 is linked with an opening valve 26 and a closing valve 28. The switch chamber 12 of switch cylinder 2 is linked with an opening valve 30 and a closing valve 32. The switch chamber 14 of switch cylinder 4 is linked with an opening valve 34 and a closing valve 36. The switch chamber 16 of switch cylinder 4 is linked with an opening valve 38 and a closing 40. The switch chamber 18 of switch cylinder 6 is linked with an opening valve 42 and a closing valve 44. The switch chamber 20 of switch cylinder 6 is linked with an opening valve 46 and a closing valve 48. The switch chamber 22 of switch cylinder 8 is linked with an opening valve 50 and a closing valve 52.

The switch chamber 24 of switch cylinder 8 is linked with an opening valve 54 and a closing valve 56. The opening valve 26, 30, 34, 38, 42, 46, 50 and 54 are linked to an additional valve 62 with a ventilation supply line 58 and on an additional valve 68 with an exhaust line 60. Closing valves 28, 32, 36, 40, 44, 52 and 56 are over additional valves 64 and 66 with an exhaust line 60 connected. The additional supply line 58 and the exhaust supply 60 can be closed/opened and/or functions can be changed separately from each other by the additional valve 62, 64, 66 and 68. Thereby it is possible that the opening valve 26, 30, 34, 38, 42, 46, 50 and 54 can over take and reverse the function of closing valve 28, 32, 36, 40, 44, 48, 52 and 56. The switch cylinder 2 described in the execution example is responsible for the switch of course R and 1 in round gear, the switch cylinder 4 for the switch of course 2 and 3 in the round gear, the switch cylinder 6 for the switch of split auxiliary transmission and the switch cylinder 8 for switching the range auxiliary transmission. A switch valve 70 is linked with the supply line 58 and a switch valve 72 with the exhaust line 60. The gear brakes that are not represented on the switch valve 70 and 72 is linked with the supply line 58 and the exhaust line 60.

Reference numerals

|                   |                            |
|-------------------|----------------------------|
| 1 switch          | 36 closing valve           |
| 2 switch cylinder | 38 opening valve           |
| 4 switch cylinder | 40 closing valve           |
| 6 switch cylinder | 42 opening valve           |
| 8 switch cylinder | 44 closing valve           |
| 10 switch chamber | 46 opening valve           |
| 12 switch chamber | 48 closing valve           |
| 14 switch chamber | 50 opening valve           |
| 16 switch chamber | 52 closing valve           |
| 18 switch chamber | 54 opening valve           |
| 20 switch chamber | 56 closing valve           |
| 22 switch chamber | 58 ventilation supply line |
| 24 switch chamber | 60 exhaust line            |
| 26 opening valve  | 62 additional valve        |
| 28 closing valve  | 64 additional valve        |
| 30 opening valve  | 68 additional valve        |
| 32 closing valve  | 70 switch valve            |
| 34 opening valve  | 72 switch valve            |